

Accumulator  
 $G_n = G_{n-1} + 0.6875 - \text{INT}(G_{n-1})$   
 Data Stream  
 $R_n = \text{INT}(G_n)$

0.6875	0
1.375	1
1.0625	1
0.75	0
1.4375	1
1.125	1
0.8125	0
1.5	1
1.1875	1
0.875	0
1.5625	1
1.25	1
0.9375	0
1.625	1
1.3125	1
1	1
0.6875	0

FIG. 2

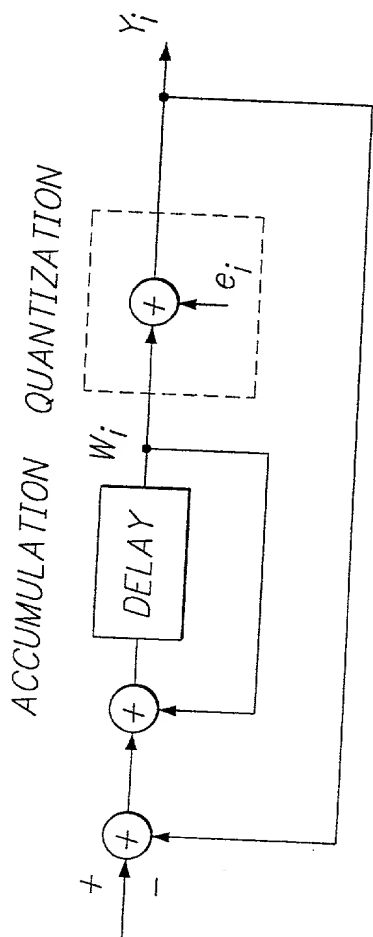


FIG. 1

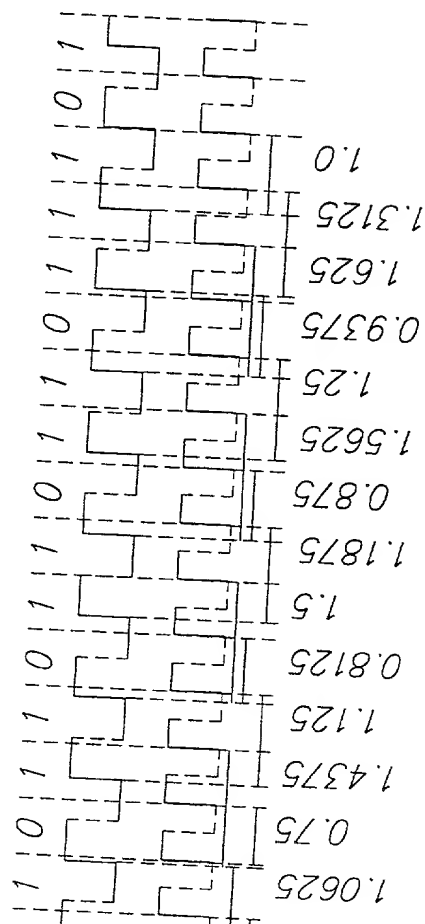


FIG. 3

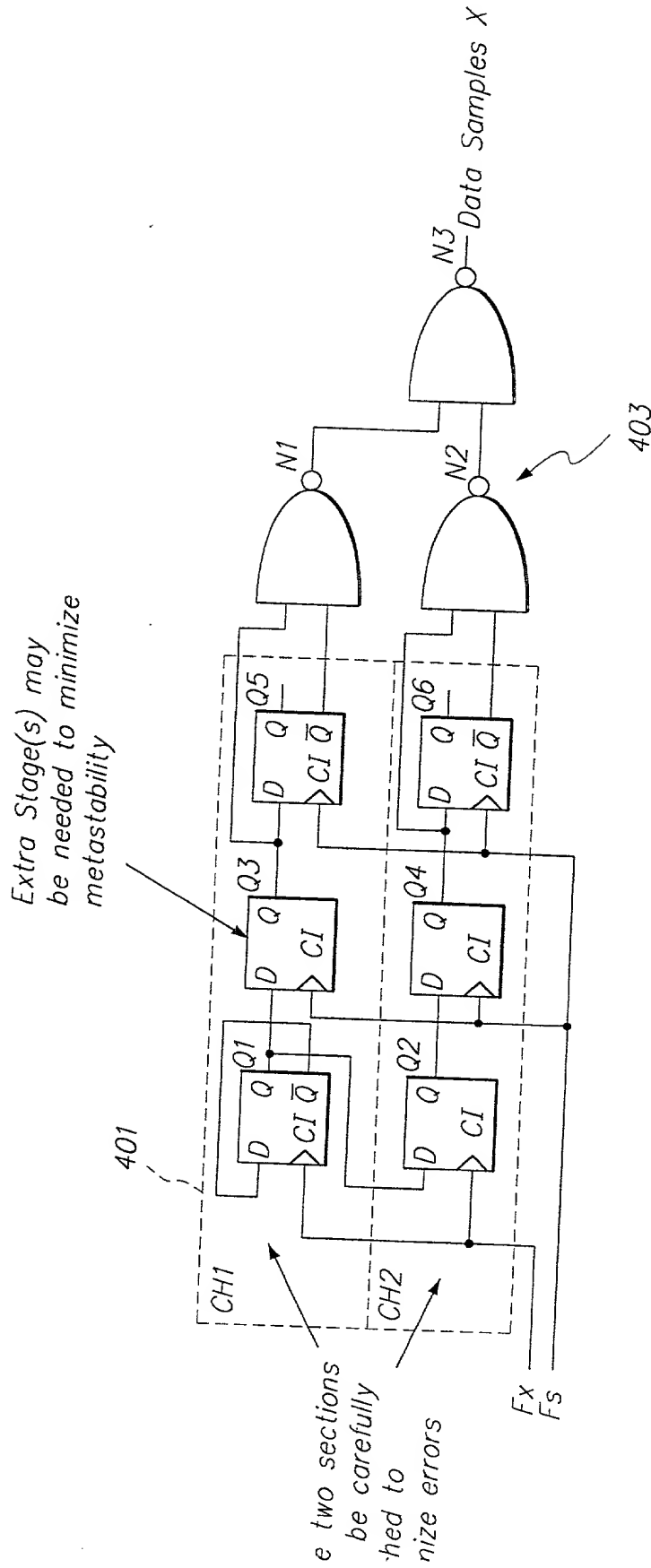
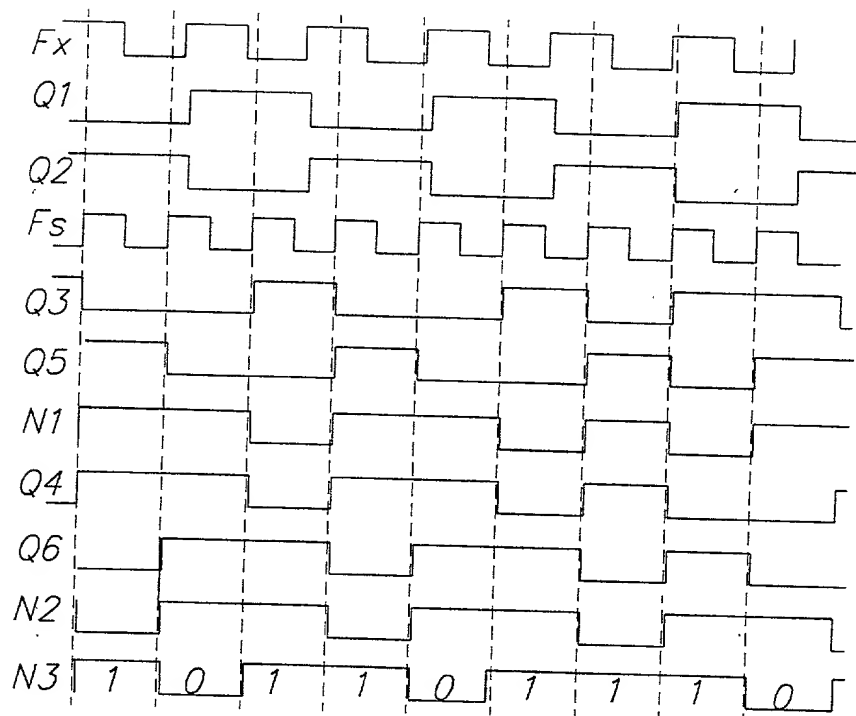
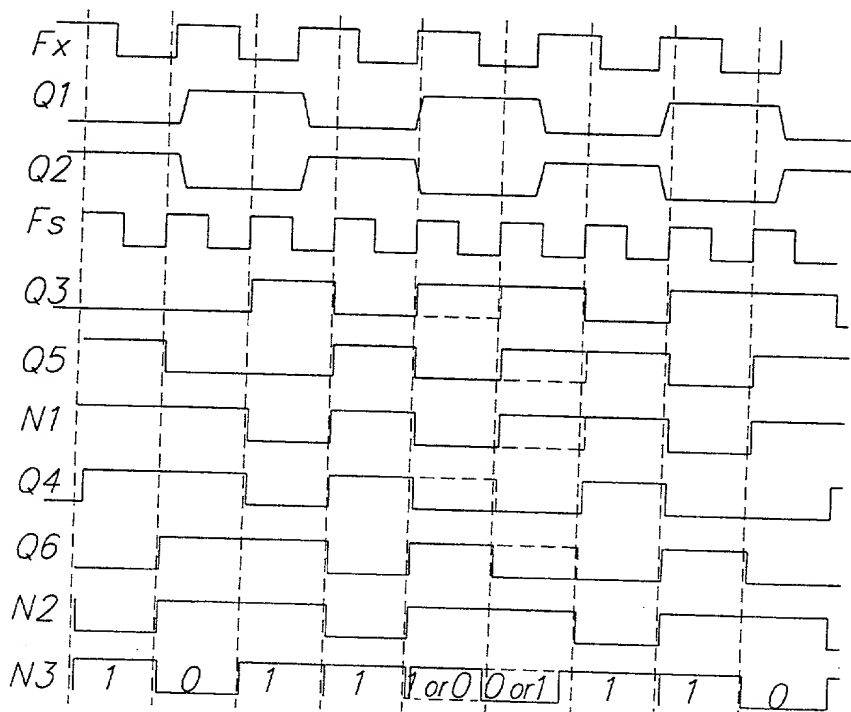


Fig. 4



**FIG. 5**



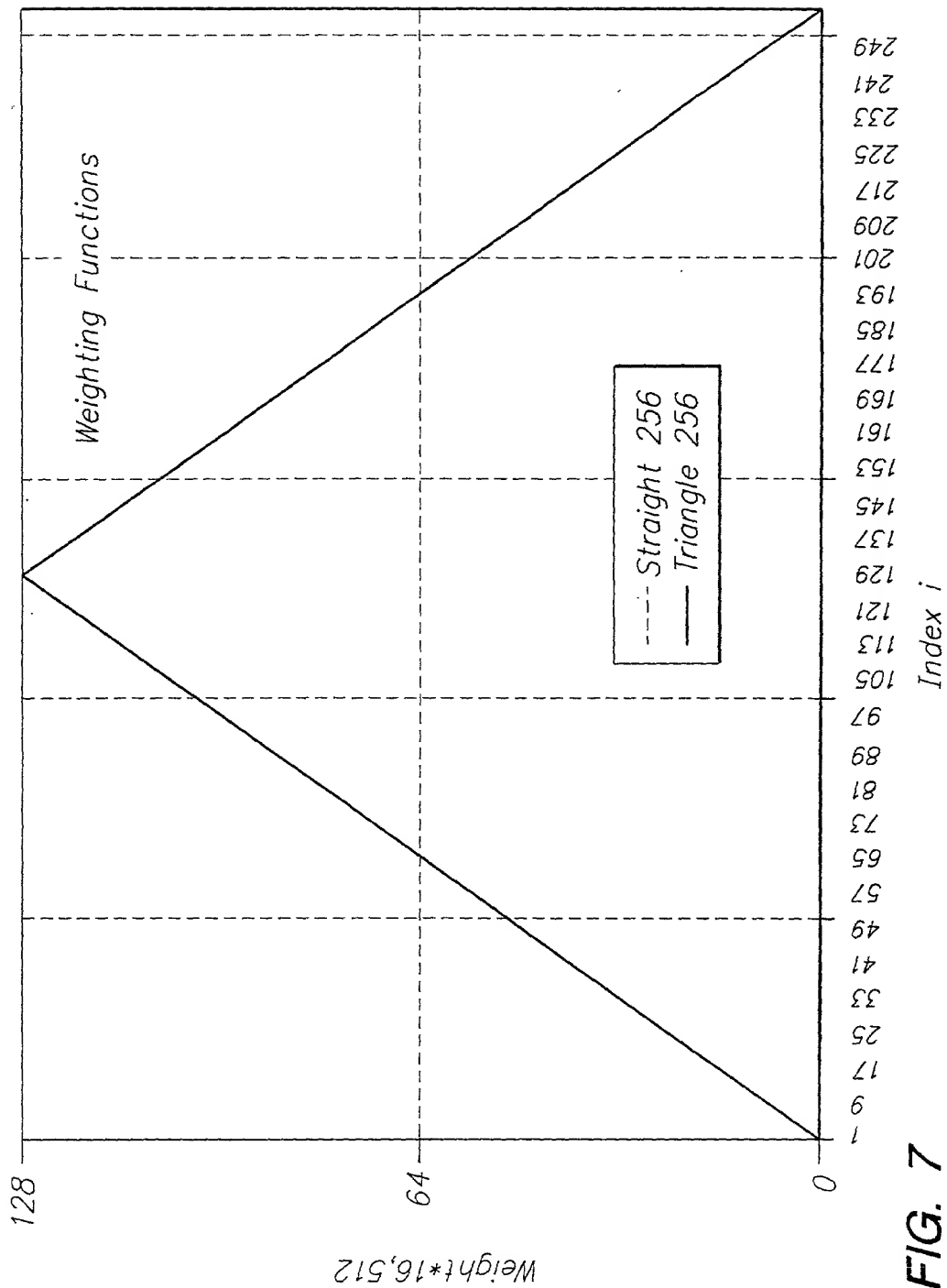


FIG. 7

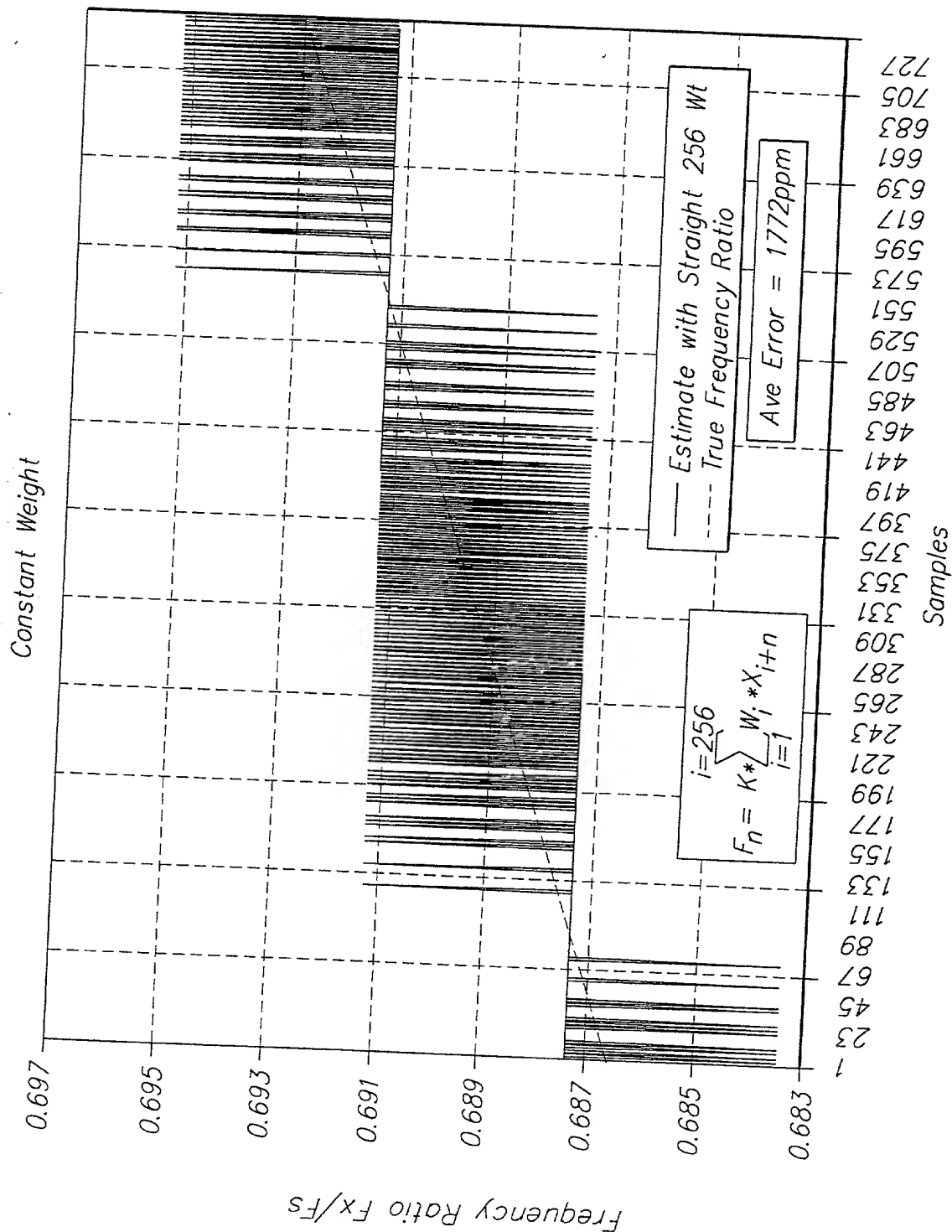
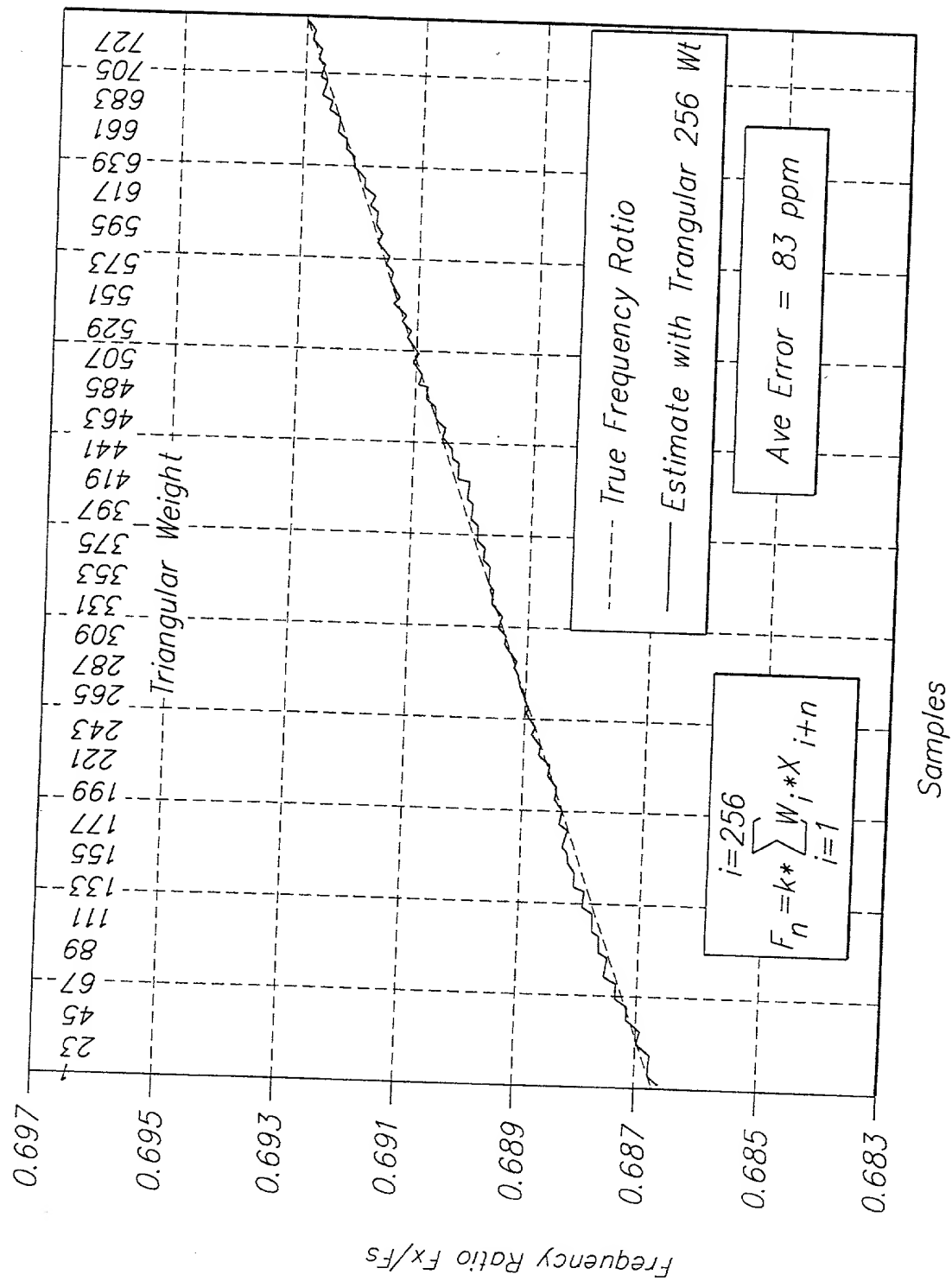


FIG. 8



**FIG. 9**

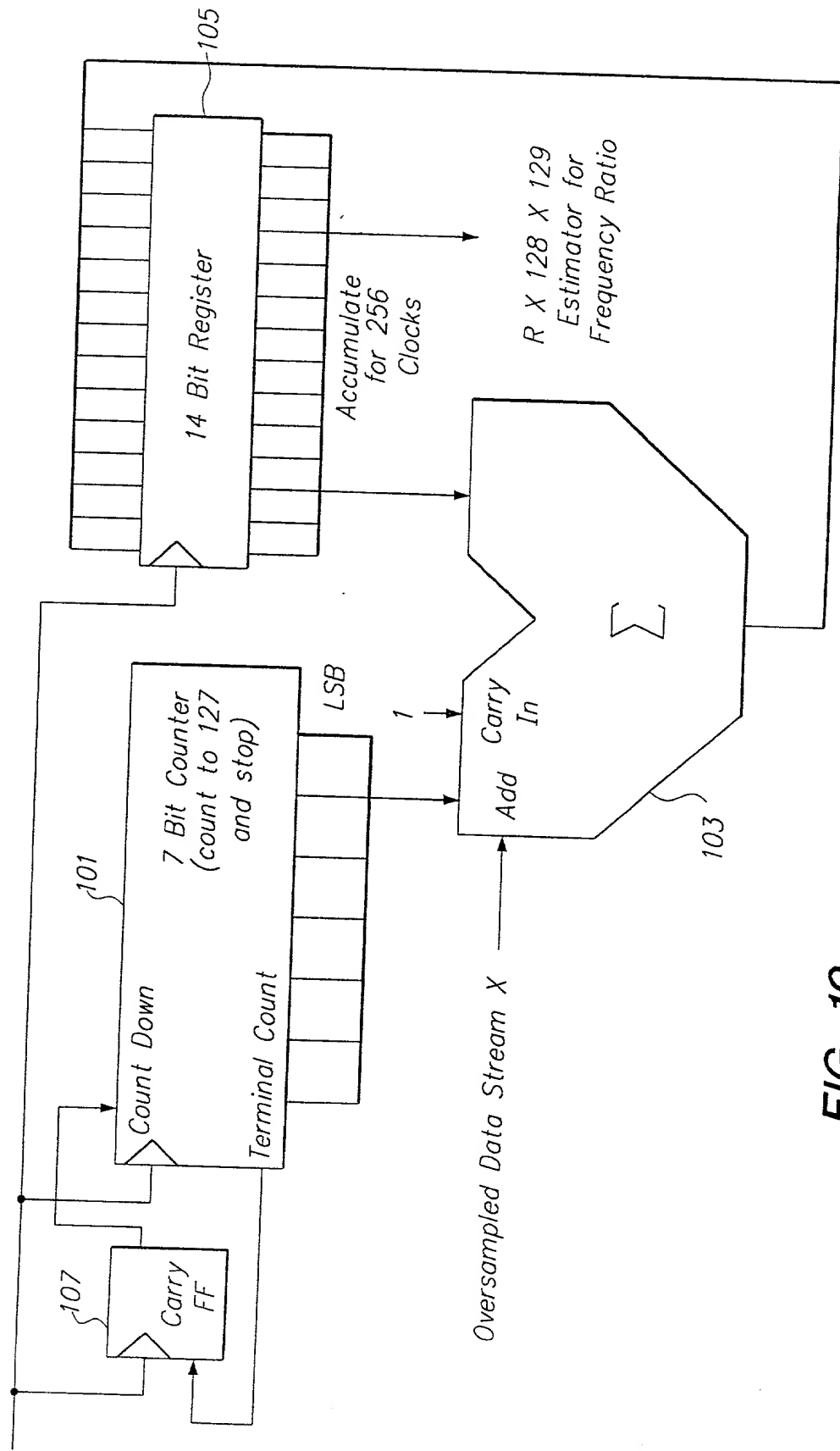


FIG. 10

FIG. 11A-1

Observed Frequency Data Stream X	Weight W	Fr Ratio = Reference Frequency/ Sample Frequency =
1	1	0.6875
1	2	
0	3	
1	4	
1	5	
0	6	
1	7	
1	8	
0	9	
1	10	
1	11	
1	12	
0	13	
1	14	
1	15	
0	16	
1	17	
1	18	
0	19	
1	20	
1	21	
0	22	
1	23	
1	24	
0	25	
1	26	
1	27	
1	28	
0	29	
1	30	
1	31	
0	32	
1	33	
1	34	
0	35	
1	36	
1	37	
0	38	
1	39	
1	40	
0	41	
1	42	

**FIG. 11A-1**

**FIG. 11A-1**

**FIG. 11A-2**

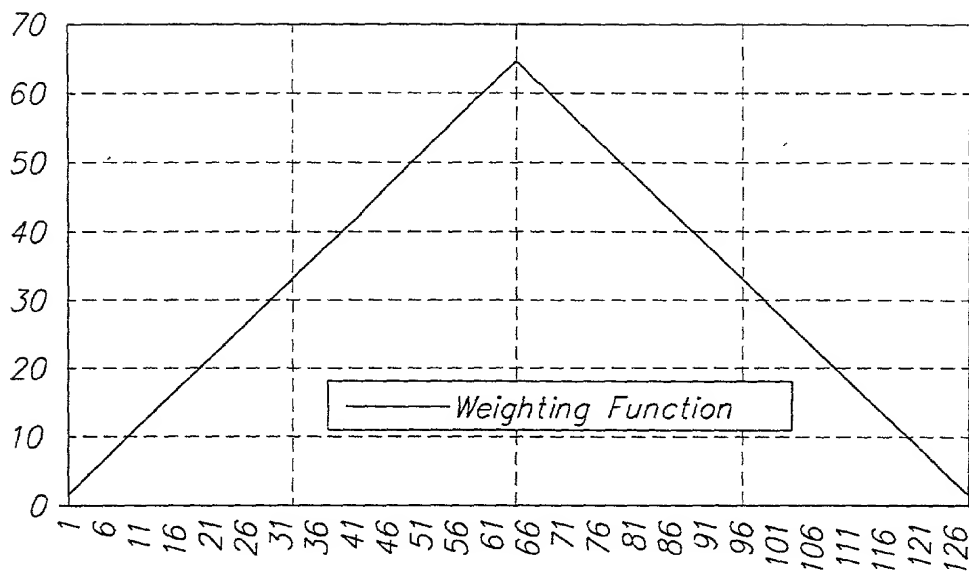
**FIG. 11A**



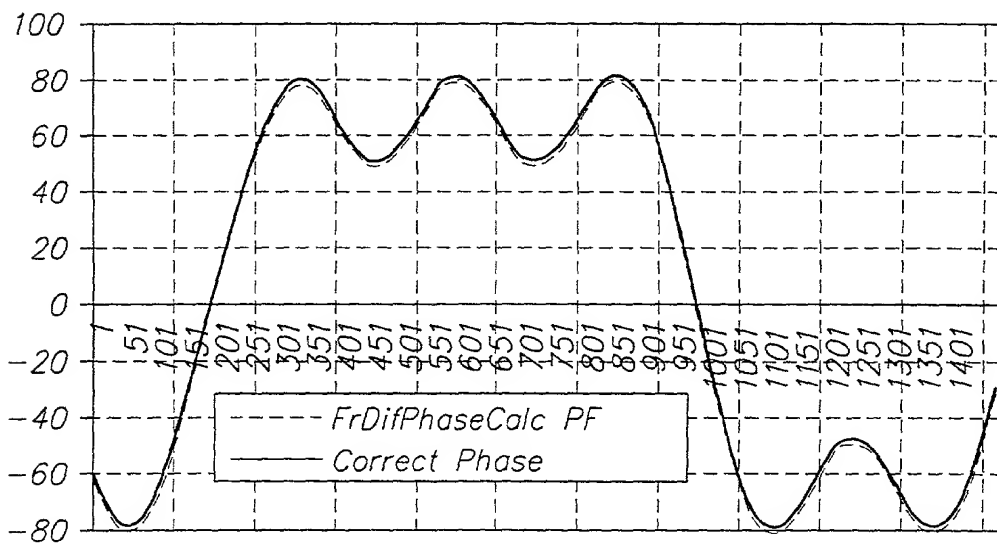
0	44
1	45
1	46
1	47
0	48
1	49
1	50
0	51
1	52
1	53
0	54
1	55
1	56
0	57
1	58
1	59
0	60
1	61
1	62
1	63
0	64
1	64
1	63
0	62
1	61
1	60
0	59
1	58

		Frequency Estimate		Integration	
		Correct Phase	$F_n =$ $\sum_i (W_i * X_{i+n})$ $F$	$\Delta F_i =$ $F_i - F_{r \text{ Ratio}}$ $\Delta F$	$PF_n =$ $PF_{n-1} * k * \Delta F_i$ $Pf$
		-53.714763	0.686058	-0.001442	-55.876923
		-54.394811	0.686058	-0.001442	-56.615385
		-55.066978	0.686058	-0.001442	-57.353846
		-55.731139	0.686058	-0.001442	-58.092308
		-56.387171	0.686058	-0.001442	-58.830769
		-57.034949	0.686058	-0.001442	-59.569231
		-57.674350	0.686058	-0.001442	-60.307692

**FIG. 11A-2**



**FIG. 11B**



Ave Error=1.501453

**FIG. 11C**

Observed Frequency Data Stream $X$	Weight $W$	$Y_i = X_i - FrRatio$ $Y$	$PX_i = PX_{i-1} + Y_i$ $P_x$	$Fr Ratio =$ Reference Frequency/ Sample Frequency = 0.6875
1	1	0.3125	0.0000	
1	2	0.3125	0.3125	
0	3	-0.6875	-0.3750	
1	4	0.3125	-0.0625	
1	5	0.3125	0.2500	
0	6	-0.6875	-0.4375	
1	7	0.3125	-0.1250	
1	8	0.3125	0.1875	
0	9	-0.6875	-0.5000	
1	10	0.3125	-0.1875	
1	11	0.3125	0.1250	
1	12	0.3125	0.4375	
0	13	-0.6875	-0.2500	
1	14	0.3125	0.0625	
1	15	0.3125	0.3750	
0	16	-0.6875	-0.3125	
1	17	0.3125	0.0000	
1	18	0.3125	0.3125	
0	19	-0.6875	-0.3750	
1	20	0.3125	-0.0625	
1	21	0.3125	0.2500	
0	22	-0.6875	-0.4375	
1	23	0.3125	-0.1250	
1	24	0.3125	0.1875	
0	25	-0.6875	-0.5000	
1	26	0.3125	-0.1875	
1	27	0.3125	0.1250	
1	28	0.3125	0.4375	
0	29	-0.6875	-0.2500	
1	30	0.3125	0.0625	
1	31	0.3125	0.3750	
0	32	-0.6875	-0.3125	
1	33	0.3125	0.0000	
1	34	0.3125	0.3125	
0	35	-0.6875	-0.3750	
1	36	0.3125	-0.0625	
1	37	0.3125	0.2500	
0	38	-0.6875	-0.4375	
1	39	0.3125	-0.1250	
1	40	0.3125	0.1875	
0	41	-0.6875	-0.5000	
1	42	0.3125	0.1250	

FIG. 12A-1

FIG. 12A-1

FIG. 12A-2

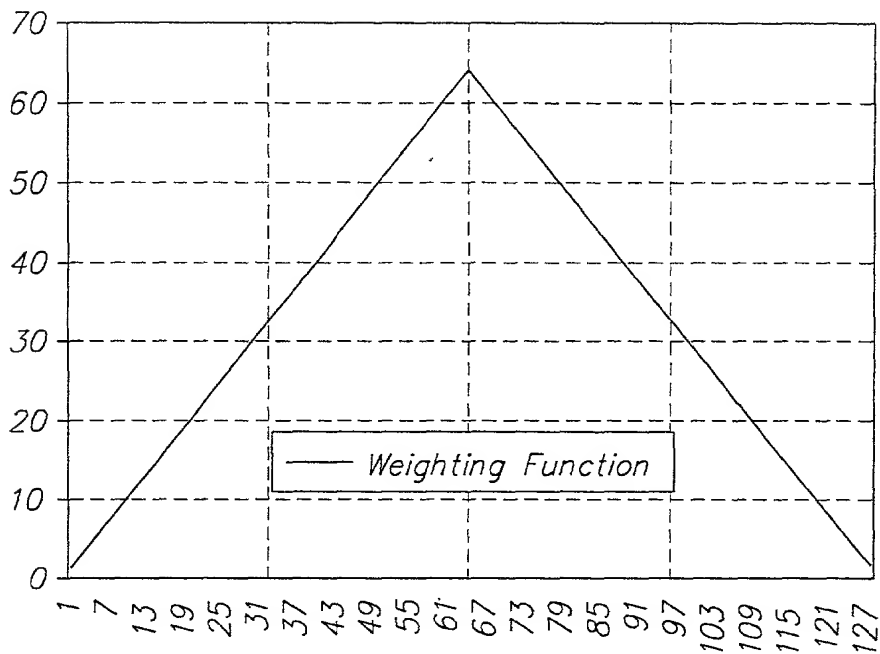
FIG. 12A

0	44	-0.6875	-0.5625		
1	45	0.3125	-0.2500		
1	46	0.3125	0.0625		
1	47	0.3125	0.3750		
0	48	-0.6875	-0.3125		
1	49	0.3125	0.0000		
1	50	0.3125	0.3125		
0	51	-0.6875	-0.3750		
1	52	0.3125	-0.0625		
1	53	0.3125	0.2500		
0	54	-0.6875	-0.4375		
1	55	0.3125	-0.1250		
1	56	0.3125	0.1875		
0	57	-0.6875	-0.5000		
1	58	0.3125	-0.1875		
1	59	0.3125	0.1250		
0	60	-0.6875	-0.5625		
1	61	0.3125	-0.2500		
1	62	0.3125	0.0625		
1	63	0.3125	0.3750		
0	64	-0.6875	-0.3125		
1	64	0.3125	0.0000	-53.714763	-55.876923
1	63	0.3125	0.3125	-54.394811	-56.615385
0	62	-0.6875	-0.3750	-55.066976	-57.353846
1	61	0.3125	-0.0625	-55.731139	-58.092308
1	60	0.3125	0.2500	-56.387171	-58.830769
0	59	-0.6875	-0.4376	-57.034949	-59.569231
1	58	0.3125	-0.1250	-57.674350	-60.307692

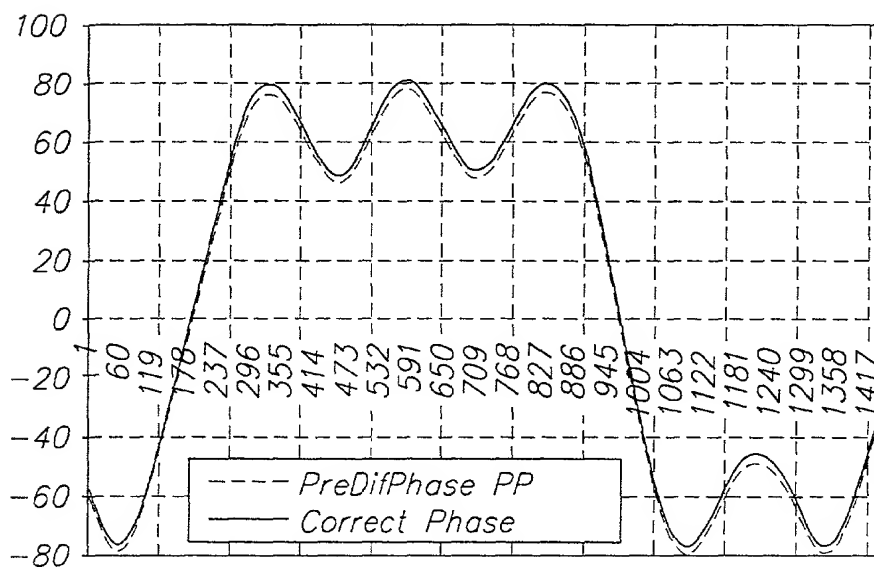
Correct  
Phase

$$PP_n = \frac{k \sum_i (W_i + PX_{i+n})}{PP}$$

FIG. 12A-2



**FIG. 12B**



Ave Error= 1.501453

**FIG. 12C**

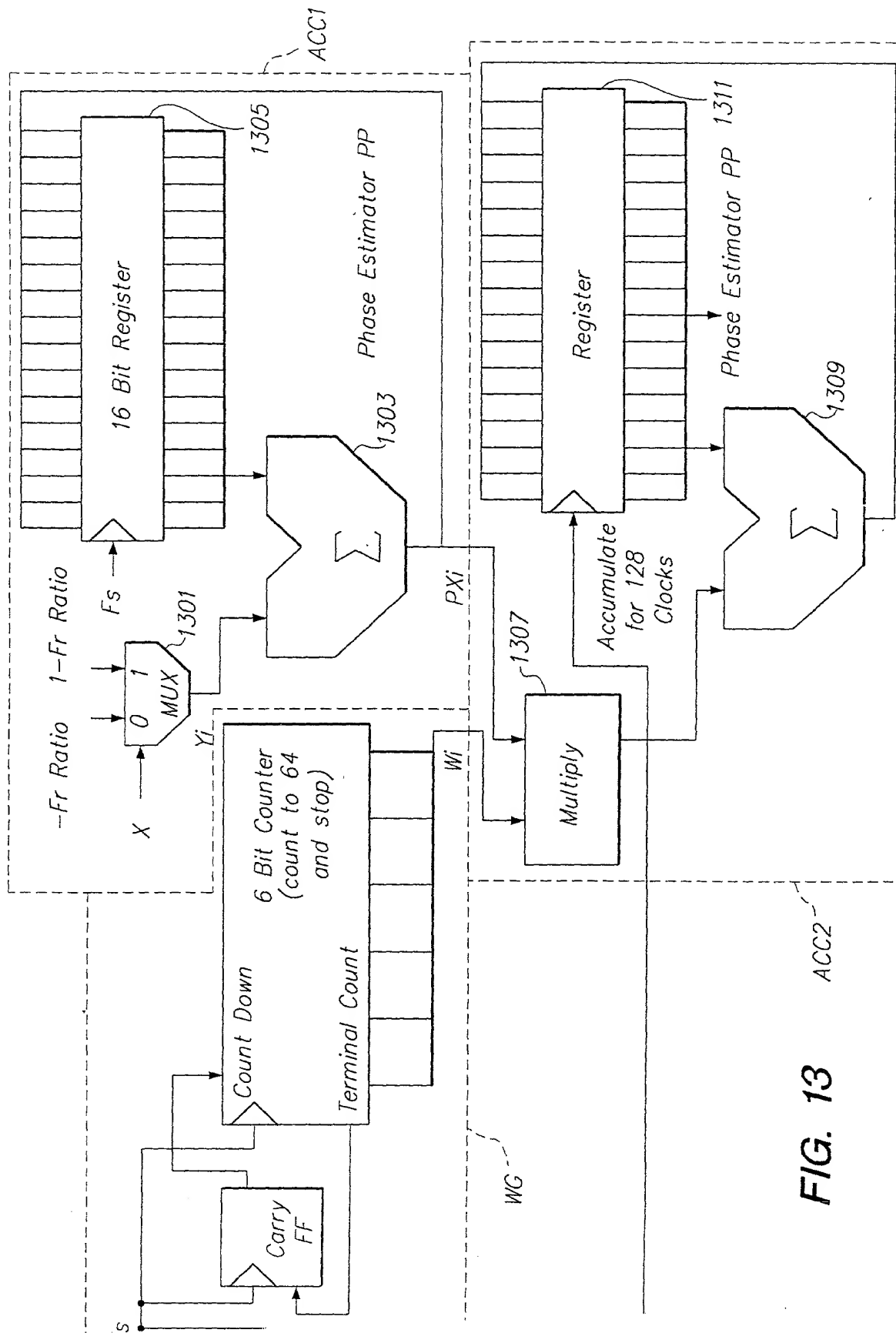


FIG. 13

Reference Frequency Data Stream <i>R</i>	Observed Frequency Data System <i>X</i>	$D_i =$ $D_{i-1} + X_i - R_i$ <i>D</i>	Weight <i>W</i>	Fr Ratio= Reference Frequency/ Sample Frequency = 0.6875
1	1	0	1	
1	1	0	2	
0	0	0	3	
1	1	0	4	
1	1	0	5	
0	0	0	6	
1	1	0	7	
1	1	0	8	
1	0	-1	9	
0	1	0	10	
1	1	0	11	
1	1	0	12	
0	0	0	13	
1	1	0	14	
1	1	0	15	
0	0	0	16	
1	1	0	17	
1	1	0	18	
0	0	0	19	
1	1	0	20	
1	1	0	21	
0	0	0	22	
1	1	0	23	
1	1	0	24	
1	0	-1	25	
0	1	0	26	
1	1	0	27	
1	1	0	28	
0	0	0	29	
1	1	0	30	
1	1	0	31	
0	0	0	32	
1	1	0	33	
1	1	0	34	
0	0	0	35	
1	1	0	36	
1	1	0	37	
0	0	0	38	
1	1	0	39	
1	1	0	40	
1	0	-1	41	

**FIG. 14A-1**

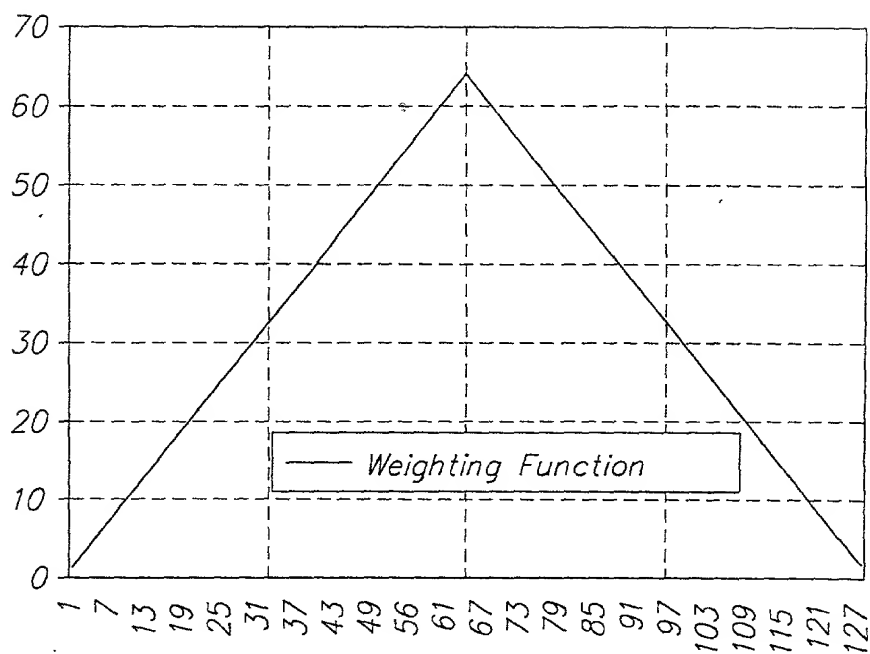
**FIG. 14A-1**

**FIG. 14A-2**

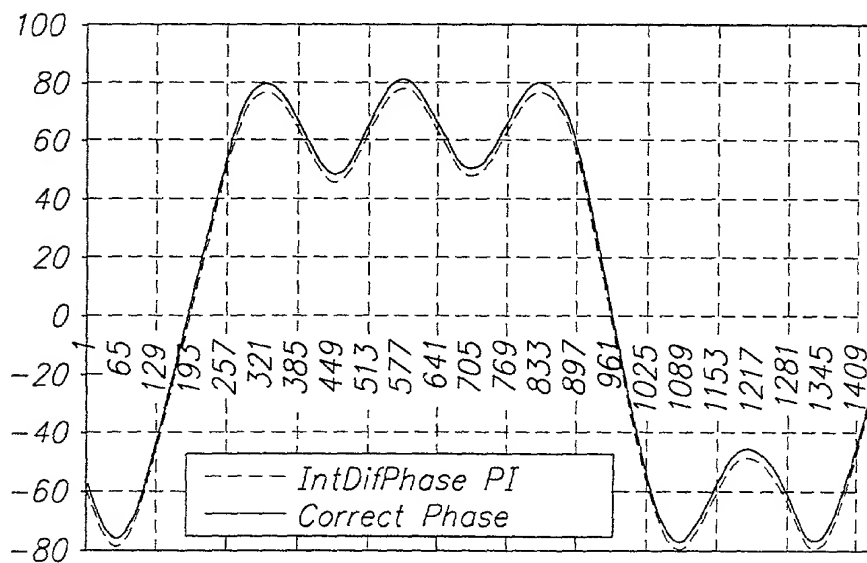
**FIG 14A**





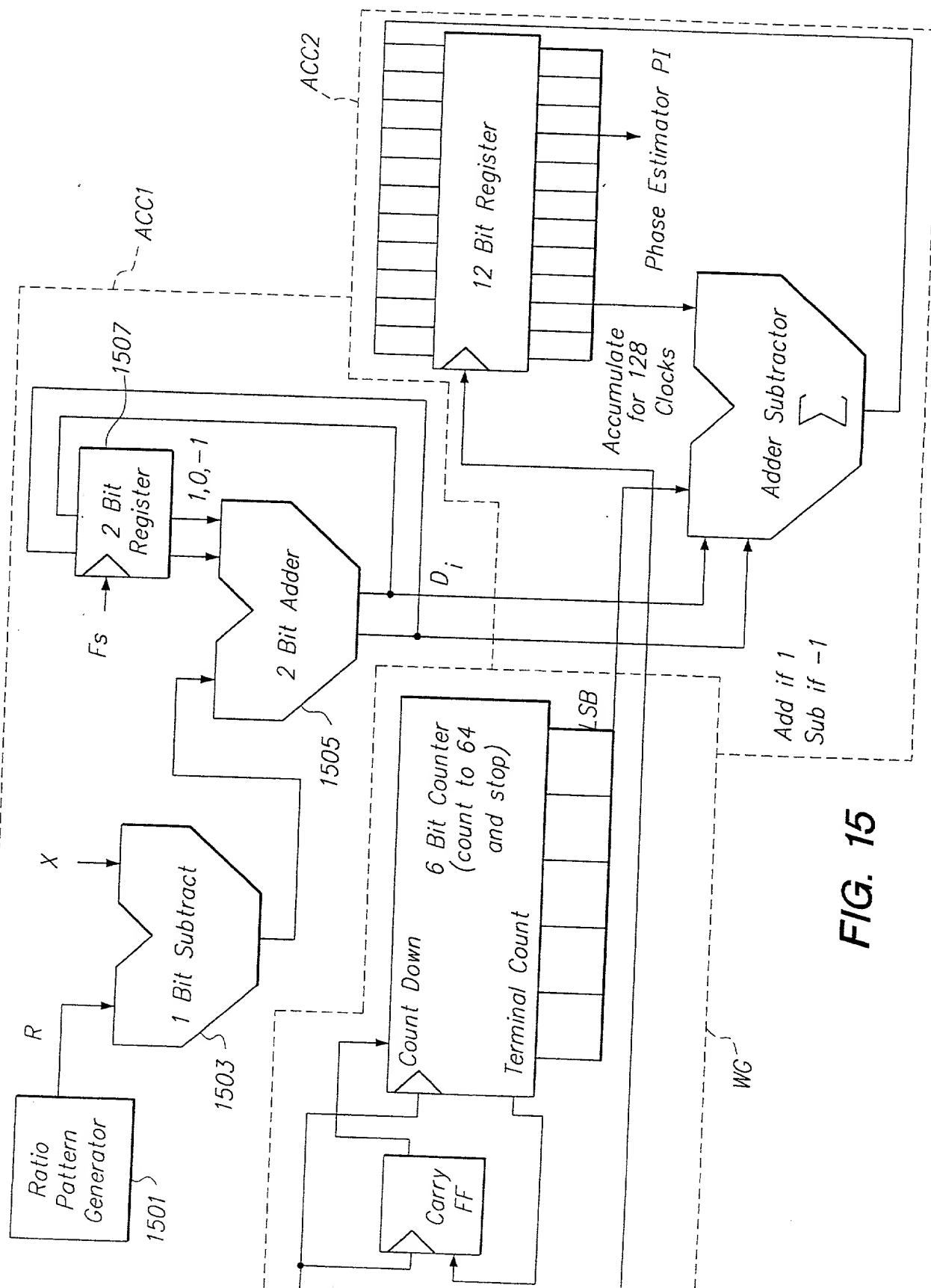


**FIG. 14B**



Ave Error= 1.501453

**FIG. 14C**



**FIG. 16A-1**

**FIG. 16A-2**

**FIG. 16A**

1.375	1	1	0	-924.5
1.0625	1	0	-1	-968
0.75	0	1	0	-1012.5
1.4375	1	1	0	-1068
1.125	1	1	0	-1104.5
0.8125	0	0	0	-1152
1.5	1	1	0	-1200.5
1.1875	1	1	0	-1250
0.875	0	0	0	-1300.5
1.5625	1	1	0	-1352
1.25	1	1	0	-1404.5
0.9375	0	0	0	-1458
1.625	1	1	0	-1512.5
1.3125	1	1	0	-1568
1	1	0	-1	-1624.5
0.6875	0	1	0	-1682
1.375	1	1	0	-1740.5
1.0625	1	0	-1	-1800
0.75	0	1	0	-1860.5
1.4375	1	1	0	-1922
1.125	1	1	0	-1984.5
0.8125	0	0	0	-2048
1.5	1	1	0	2048
1.1875	1	1	0	1984.5
0.875	0	0	0	1922
1.5625	1	1	0	1860.5
1.25	1	1	0	1800
0.9375	0	0	0	1740.5
1.625	1	1	0	1682
1.3125	1	1	0	1624.5

Correct Phase	$PC_n =$ $k*(D_n - \frac{frac(RG_n)}{PC} + 0.5 + \sum_i (W_i * X_{i+n-64}))$
-53.374738	-55.507692
-54.054787	-56.246154
-54.730895	-56.984615
-55.399059	-57.723077
-56.059155	-58.461538
-56.711060	-59.200000
-57.354650	-59.938462
-57.939800	-60.676923

FIG. 16A-2

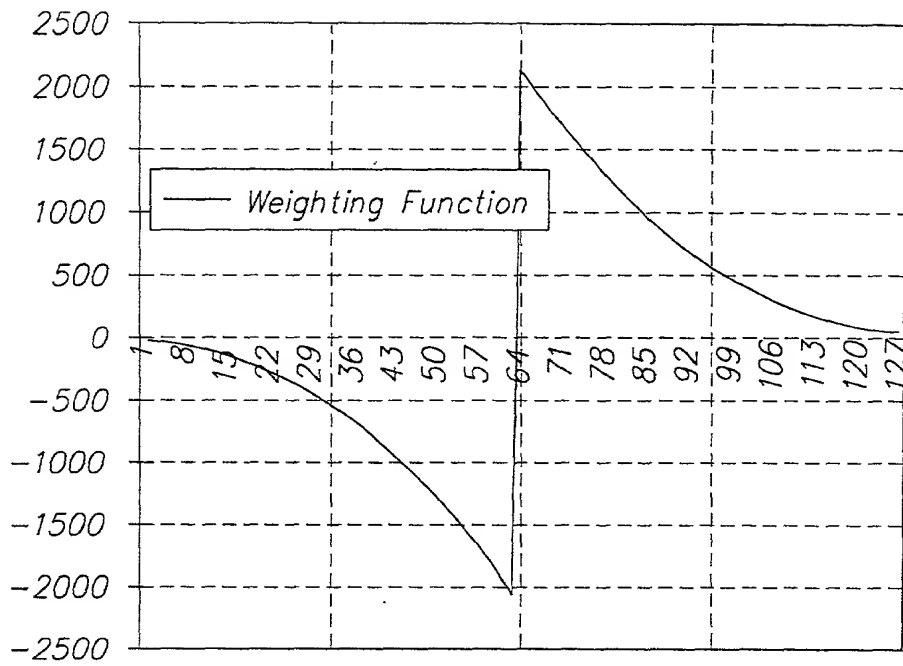
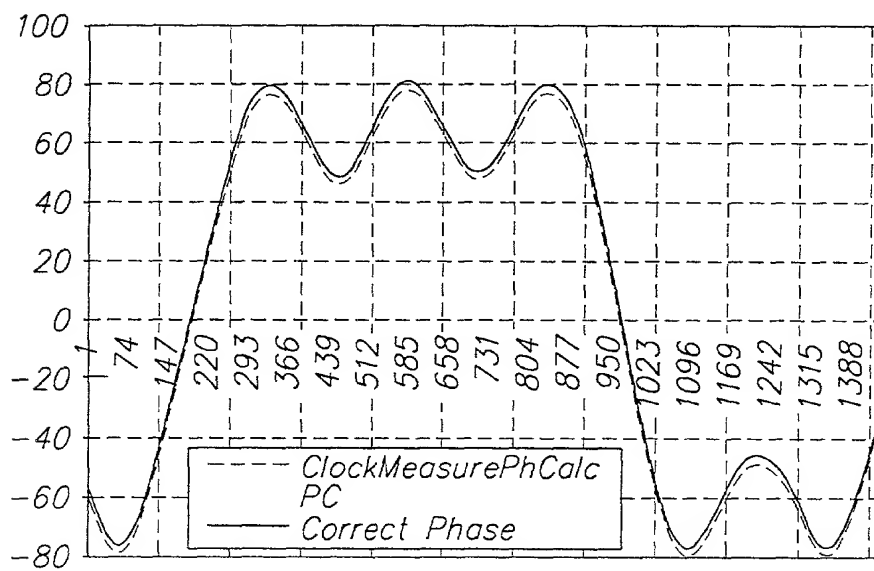


FIG. 16B



Ave Error= 1.501476

FIG. 16C

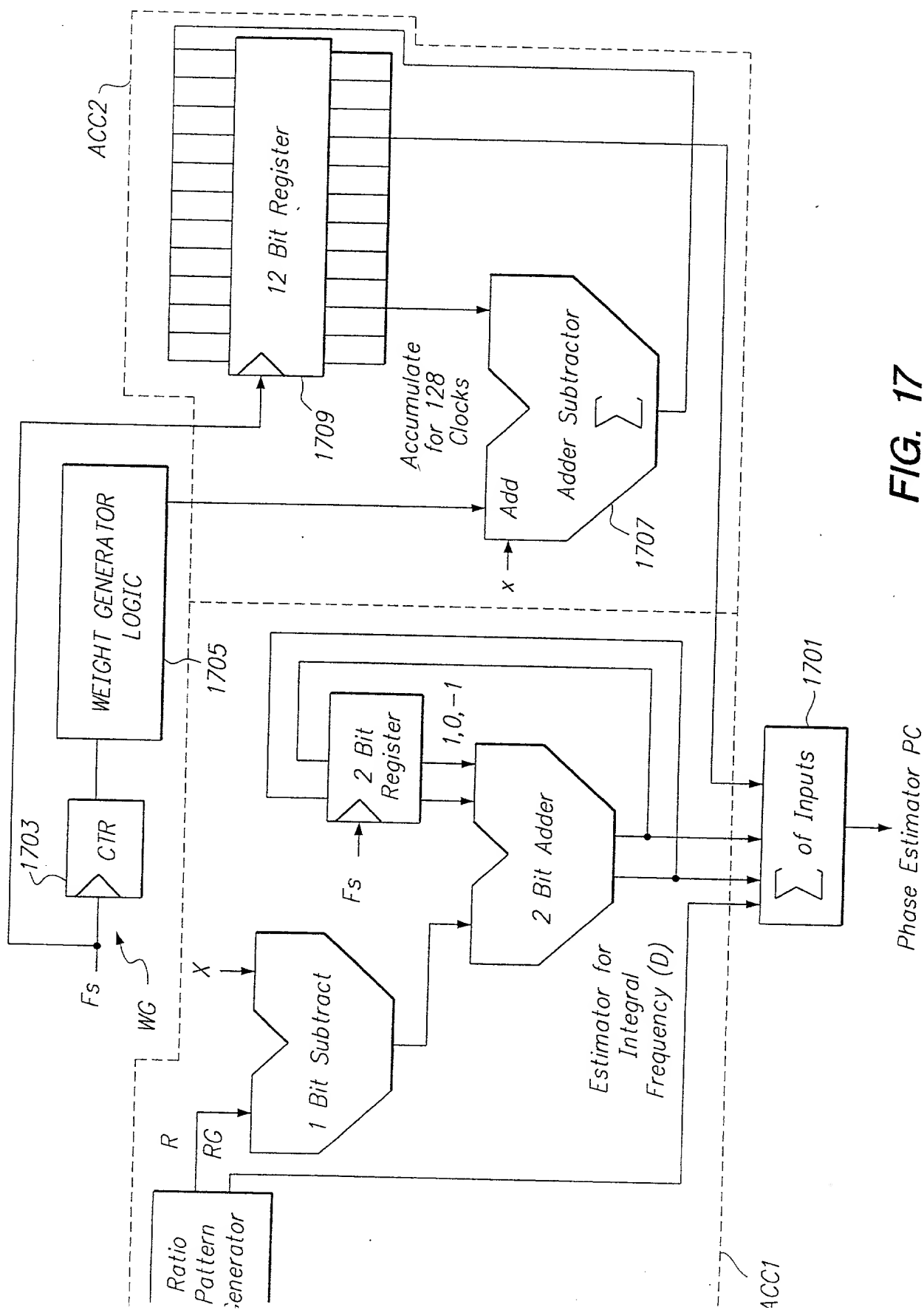


FIG. 17